



# Sub-metering to Electricity Use in Large-scale Commercial Buildings

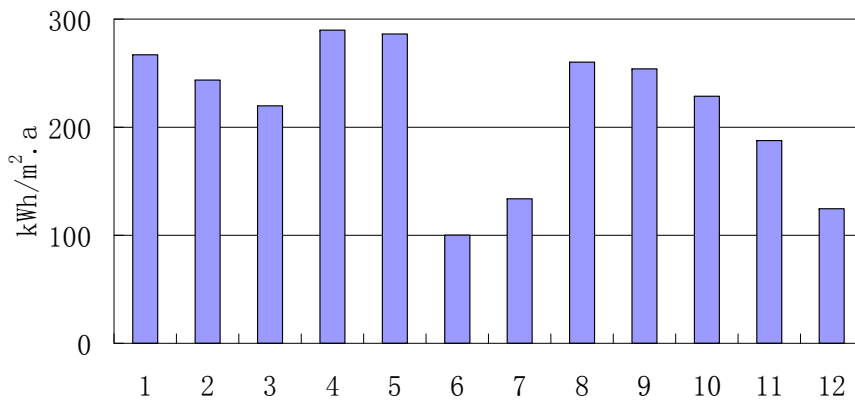
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Tsinghua University  
2006.11

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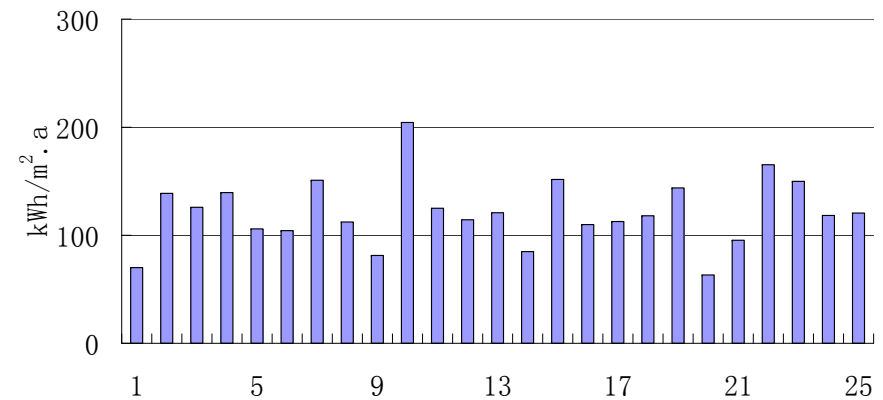
- Situation of Energy consumption in commercial buildings
- Significance of sub-metering and statistics
- Method to actualize sub-metering
- Practice——Project example
- Use of data—— Analysis Software

# Situation—— 4 types of large-scale commercial building

Shopping mall

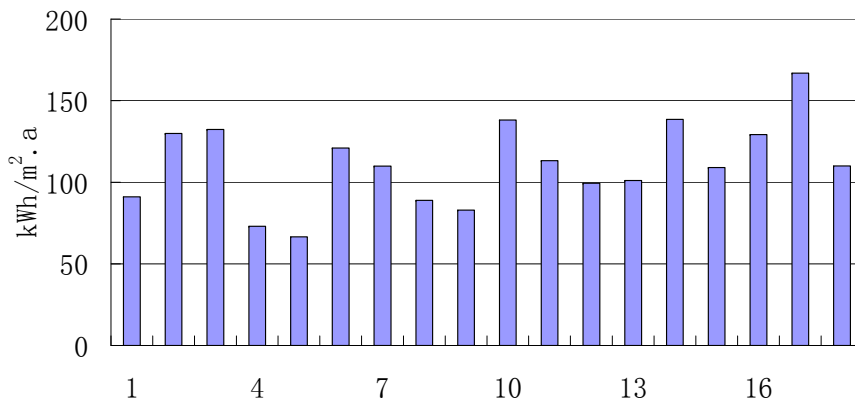


Hotel



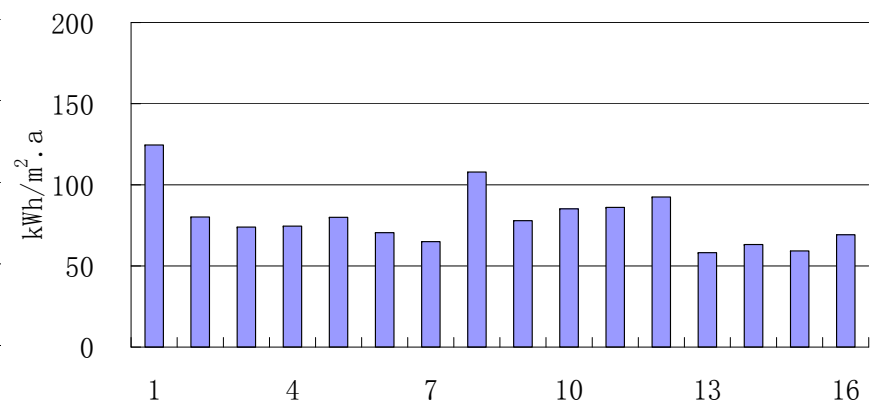
different characteristic of

Office building



energy system and operation time

Government office building



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# Situation

## ■ Great Difference between each type

Type	Sampling amount number	Mean EC	Sampling limit error	Authentic boundary
		(kWh/m <sup>2</sup> .a)	(kWh/m <sup>2</sup> .a)	(kWh/m <sup>2</sup> .a)
Shopping mall	<b>12</b>	<b>216</b>	<b>24</b>	<b>192~240</b>
Hotel	<b>25</b>	<b>121</b>	<b>8</b>	<b>113~129</b>
Office Building	<b>18</b>	<b>111</b>	<b>8</b>	<b>103~119</b>
government office building	<b>45</b>	<b>82</b>	<b>7</b>	<b>75~89</b>

# Situation of Energy consumption in Large-scale commercial buildings

Types	Area (billion m <sup>2</sup> )	Total consumption (billion kWh/a)	Unit area consumption (kWh/m <sup>2</sup> ·a)
Residential buildings	10	200	10~30
Common commercial buildings	5.5	160	20~60
Large-scale commercial buildings	0.5	100	70~300
Total	16	460	29

- Where? How much? Which? What ?
- complex electrical systems
- lack of separate measure meters

# Significance

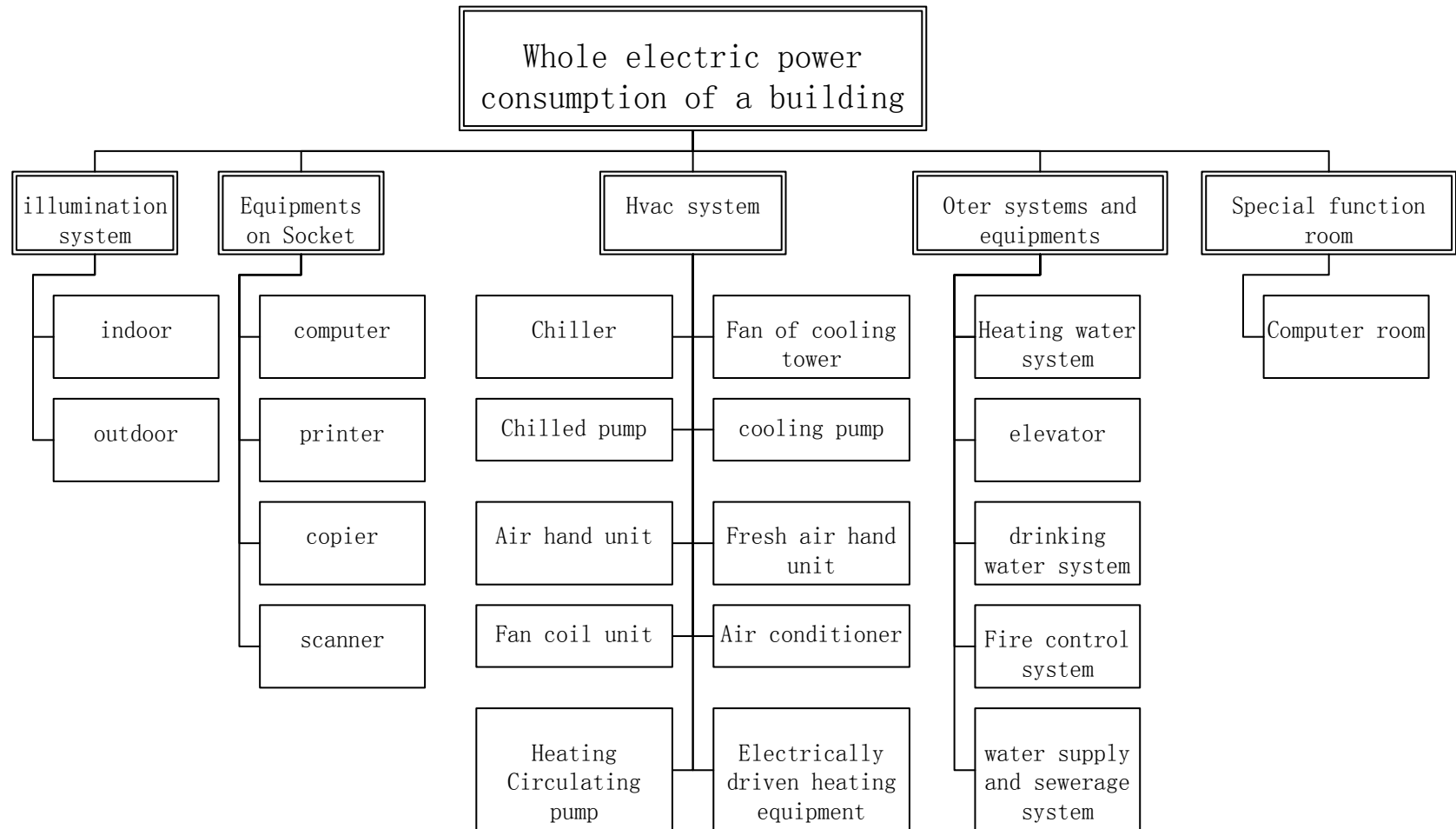
## ■ Sub-metering

- ☐ Get the real-time and exact data of each system
- ☐ Analyze the building energy consumption
- ☐ Identify the inappropriate problem timely
- ☐ Diagnose the building energy efficiency procedure
- ☐ Evaluate the effectiveness of retrofit
- ☐ Base for statistics

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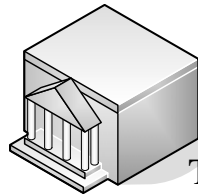
# Method of sub-metering



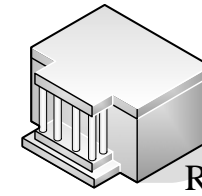


# Method of sub-metering

Real-time electricity  
consumption data

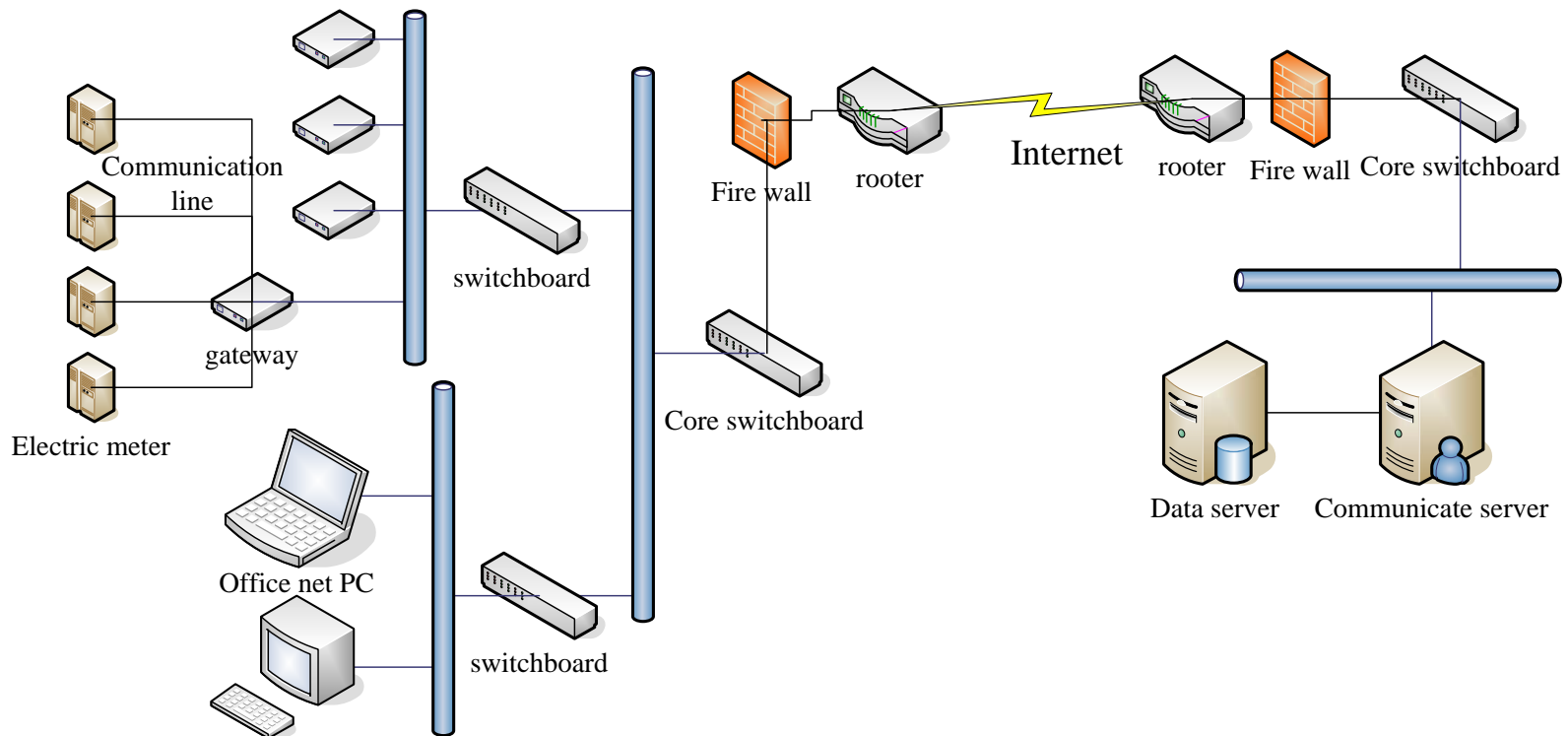


Target building



Database

Research center



# Project example

- An office building in Beijing, 45450m<sup>2</sup>

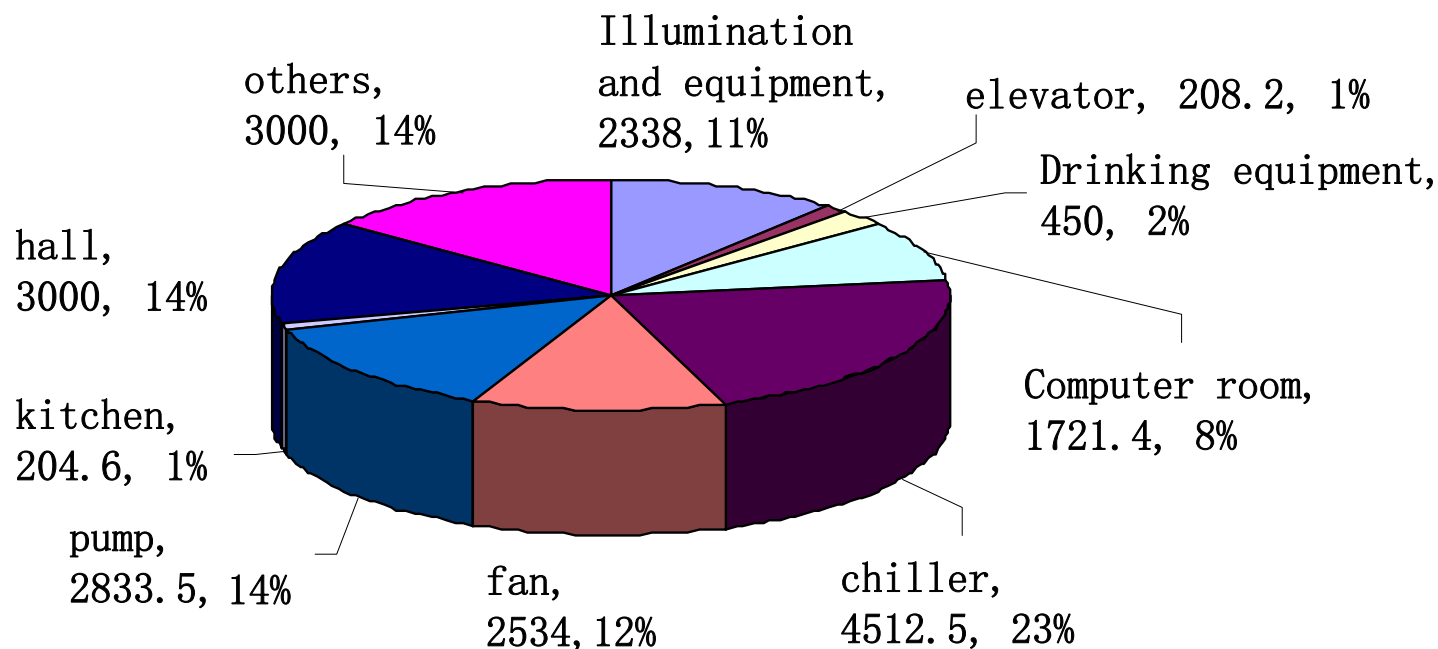
- Electric meters



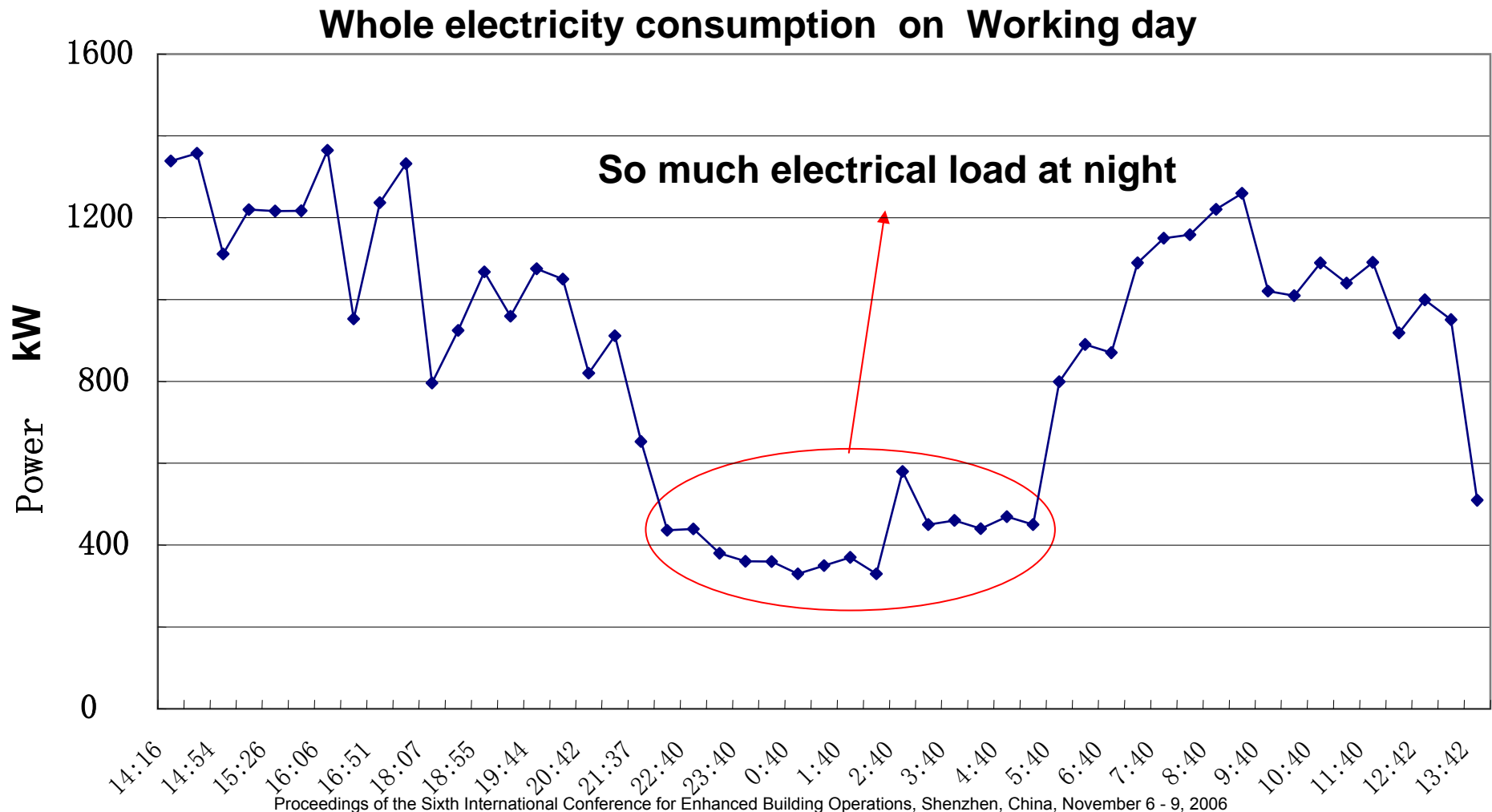
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# Results

## electricity consumption of every system on Working day

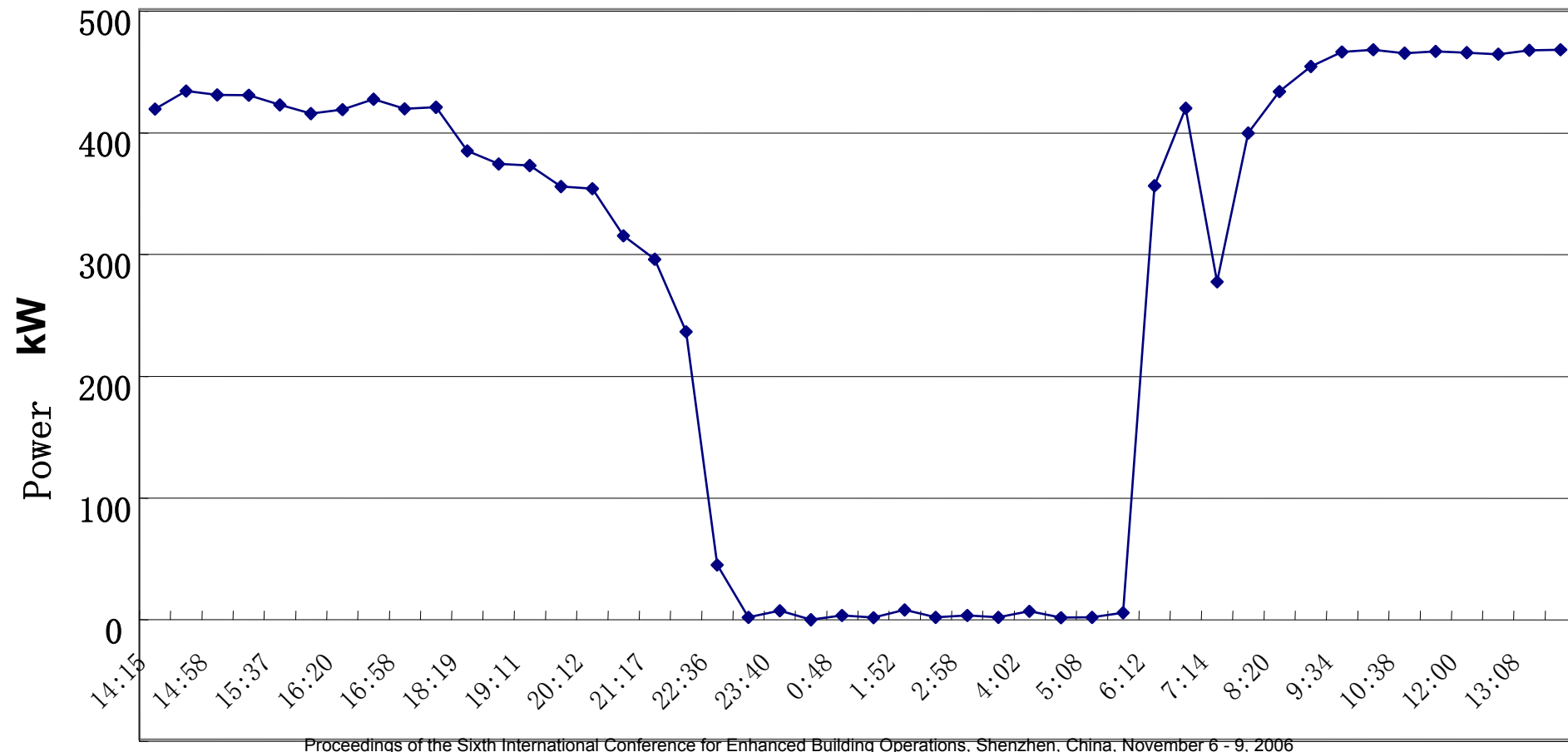


# Analysis



# Analysis

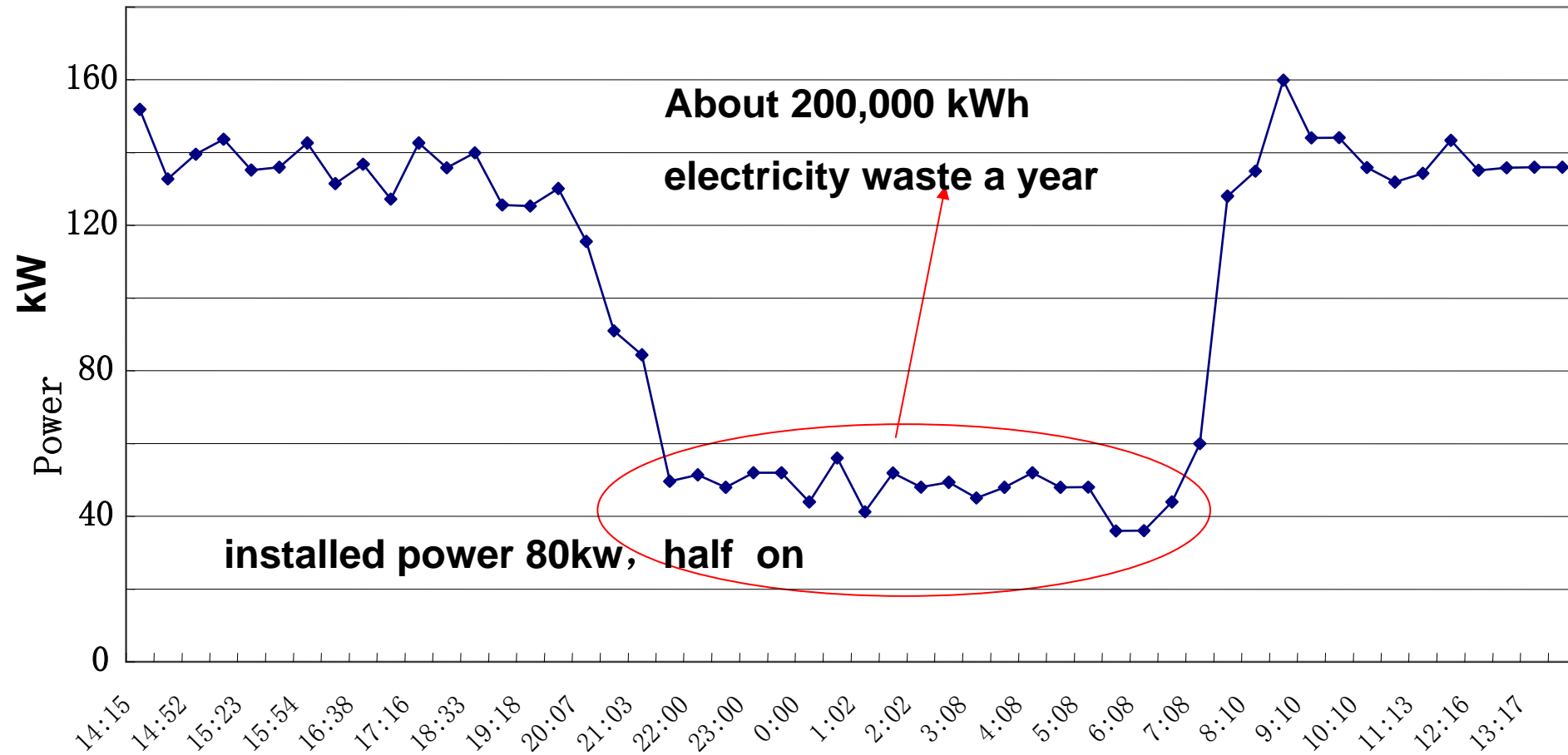
## Electricity consumption of chiller



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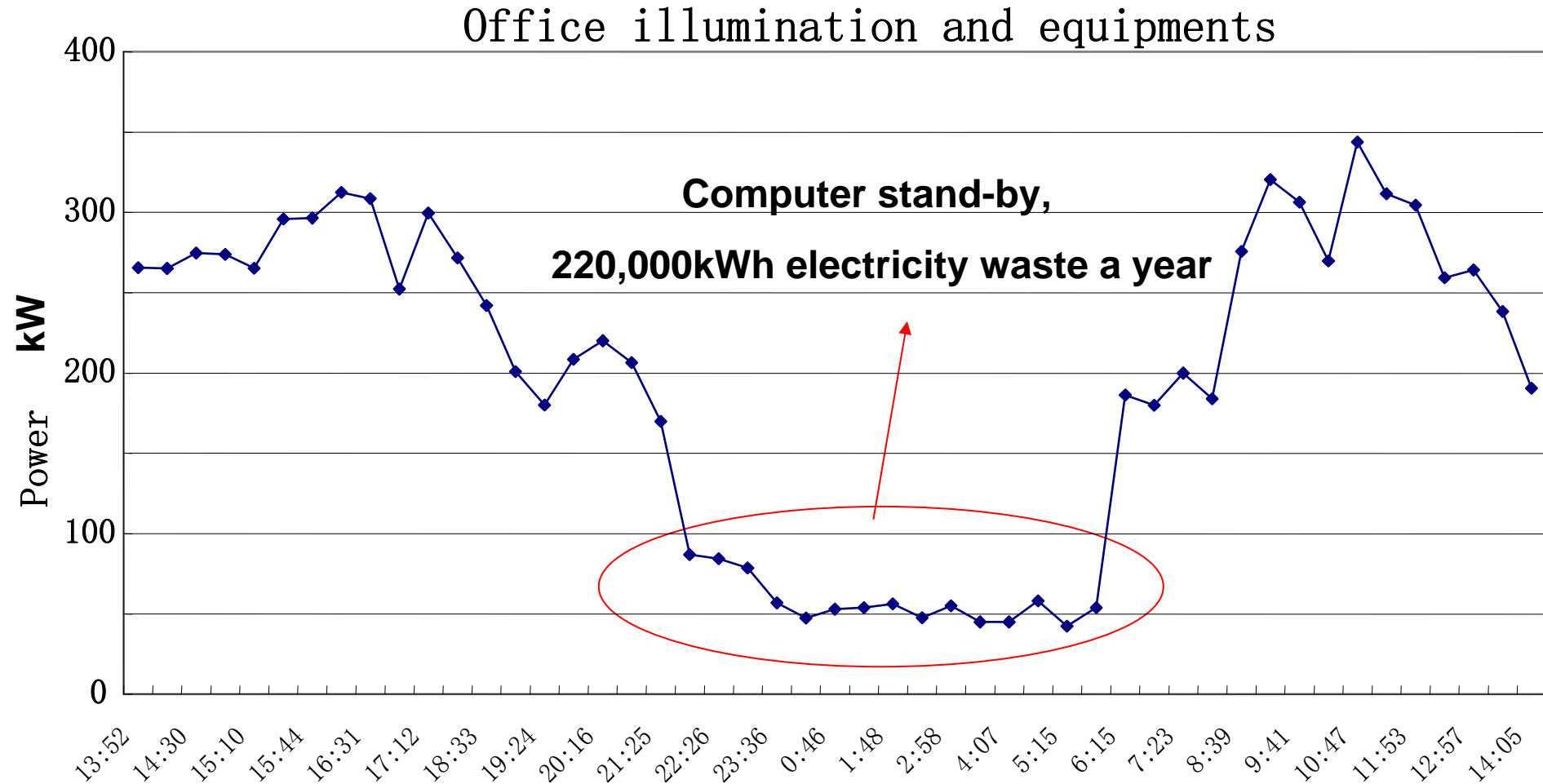
# Analysis

## Electricity consumption of fan coil unit



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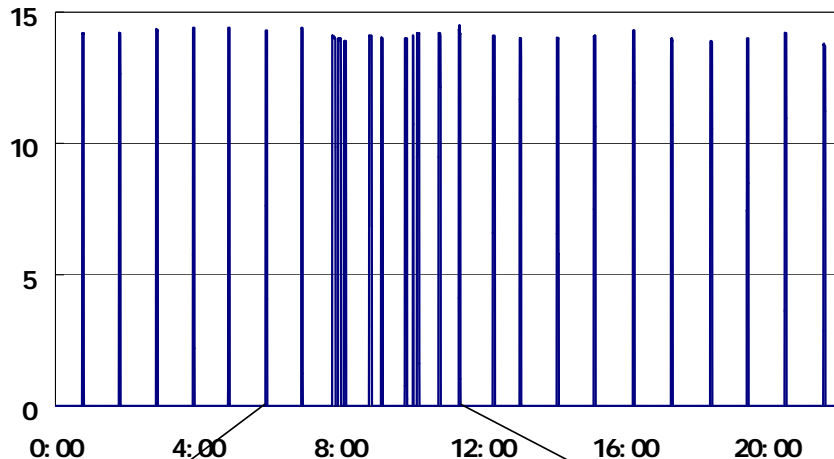
# Analysis



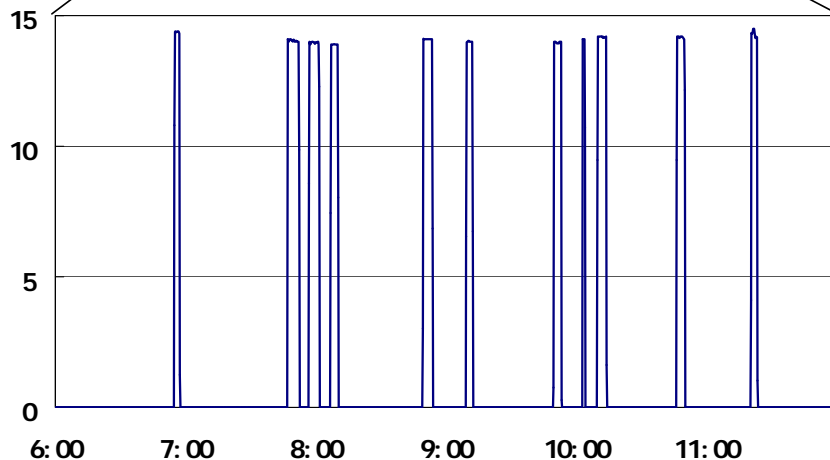
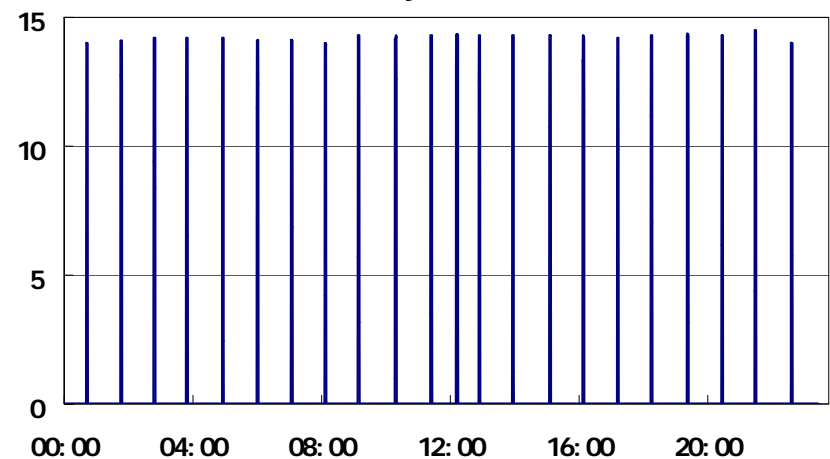
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# Schedule of water heater

Electricity on week day



Electricity on weekend



Week day:13.54kWh, need time control

Weekend:10.12kWh, need off

Heat preservation cost more

Heating just a bit

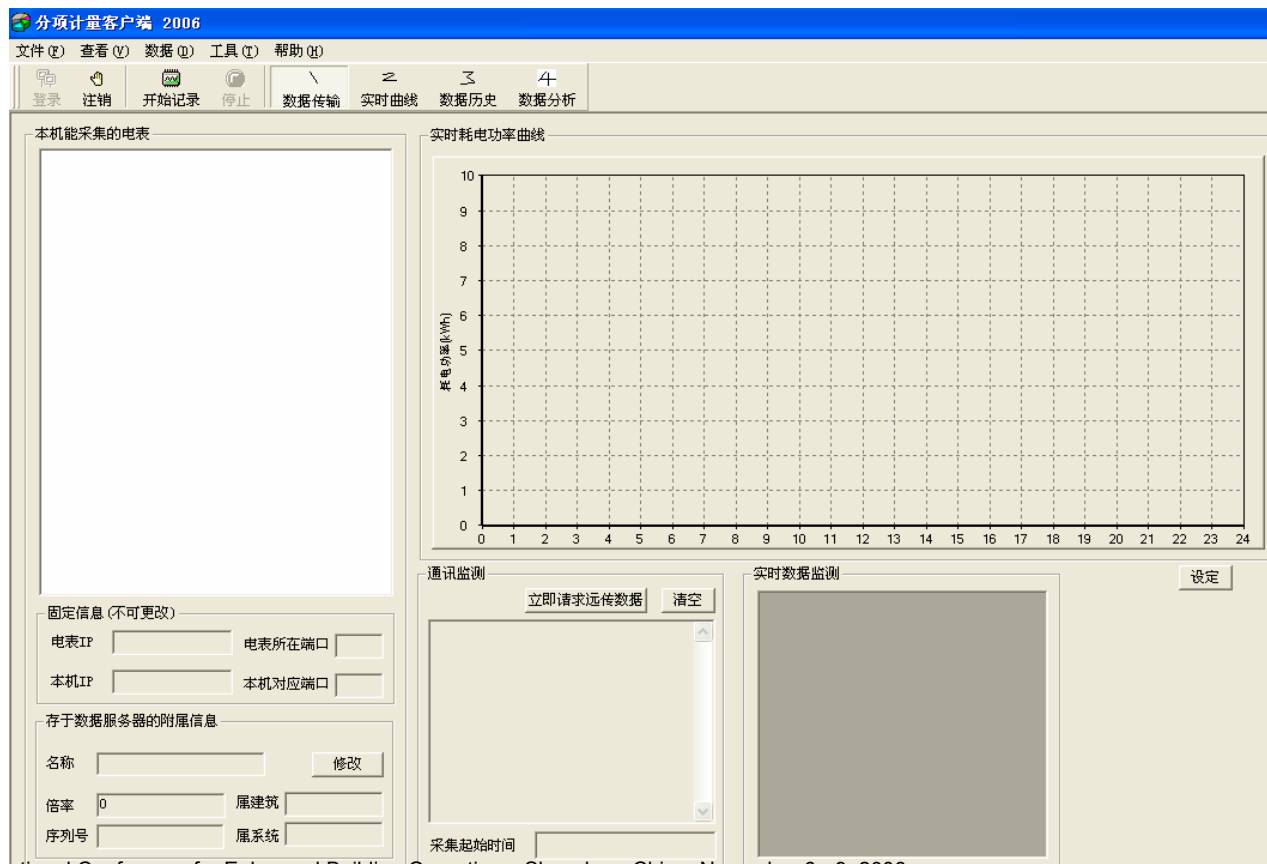


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# Analysis Software

## ■ Interface of the software



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# Thank you!